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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/719,784	11/21/2003	Stephen R. Forrest	10644/60902	2938

26646 7590 07/21/2008
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EXAMINER	
BARTON, JEFFREY THOMAS	

ART UNIT	PAPER NUMBER
1795	

MAIL DATE	DELIVERY MODE
07/21/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/719,784	FORREST ET AL.	
	Examiner	**Art Unit**	
	Jeffrey T. Barton	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _16 June 2008_.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _18-39_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _18-39_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. The amendment filed on 05 November 2007 does not place the application in condition for allowance.

Status of Rejections Pending Since the Office Action of 23 July 2007

2. All rejections are maintained.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein

were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claims 18, 19, 22-25, and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Forrest et al (WO 00/11725) in view of Sato et al (U.S. Patent 4,479,028) and Hanak (U.S. Patent 4,316,049).

As seen in Figure 8A, 8B, 8C, 8D, and 9 Forrest et al '725 teaches a stacked organic photosensitive optoelectronic device that comprises in order, an anode, a plurality of photosensitive optoelectronic subcells, and a cathode (see page 1, lines 12-15; page 7, line 33 through page 37, line 1). An example of a heterojunction for a subcell in the stacked device is CuPc/PTCDA or CuPc/PTCBI (see the paragraph bridging cols. 33 and 34). Other heterojunctions are shown on Table 1 at pages 44-45, and include heterojunctions that have C_{60} buckminsterfullerene as an electron transport layer. Between each of the subcells is a semitransparent metallic layer of, for example, 10% Ag and 90% Mg, which has a thickness of 100 Angstroms or less, i.e., instant electron-hole recombination zone (see page 34, line 12 through page 35, line 26). Forrest et al '725 teaches that a stacked device which is connected in series as in embodiment 8D00 in Figure 8D, "fundamental current continuity considerations constrain the device's current output so that it is limited to the current which goes through the subcell generating the least current regardless of the relative position of a

subcell in the stack" (see page 38, lines 22-27). Forrest et al '725 addresses this problem by varying the thickness of the photoconductive organic layers, e.g., such that each subcell has exponentially thicker photoconductive organic layers if measured starting at the top of the device (see page 38, line 27 through page 39, line 1). Alternatively, when sufficient electromagnetic radiation incident on each face is able to traverse the device, then the layers in the subcells in the center of the device are made thicker than the layers in subcells (see page 39, lines 9-13). The adjustment of the thickness of the sublayers is to provide uniform current levels from each cell (see page 39, lines 12-13). In any event, said semitransparent metallic layer of, for example, 10% Ag and 90% Mg, which has a thickness of 100 Angstroms or less can also be present with an ITO layer as a composite charge transfer layer between the subcells in said Figure 8D. Forrest et al '725 teaches the limitations of the instant claims, other than the differences which are discussed below.

With respect to claims 18 and 25, and as noted above, Forrest et al '725 discloses a semitransparent metallic layer of, for example, 10% Ag and 90% M, which has a thickness of 100 Angstroms or less, whereas claim 18 calls for a thickness of less than about 20 Angstroms and claim 25 calls for a thickness of less than about 5 Angstroms. However, in the absence of anything unexpected, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have prepared Forrest et al '725's semitransparent metallic layer with a thickness of less than about 20 Angstrom or 5 Angstrom because Forrest et al '725 discloses a

semitransparent metallic layer of, for example, 10% Ag and 90% M, which has a thickness of 100 Angstrom or less, which encompasses the instantly claimed ranges.

Forrest et al ‘725 does not specifically recite that the current generated by two of its subcells differs by less than 10%. However as noted above, Forrest et al ‘725 teaches that a stacked device which is connected in series as in embodiment 8D00 in Figure 8D, “fundamental current continuity considerations constrain the device’s current output so that it is limited to the current which goes through the subcell generating the least current regardless of the relative position of a subcell in the stack” (see page 38, lines 22-27). Forrest et al ‘725 addresses this problem by varying the thickness of the photoconductive organic layers, e.g., such that each subcell has exponentially thicker photoconductive organic layers if measured starting at the top of the device (see page 38, line 27 through page 39, line 1). Alternatively, when sufficient electromagnetic radiation incident on each face is able to traverse the device, then the layers in the subcells in the center of the device are made thicker than the layers in subcells (see page 39, lines 9-13). The adjustment of the thickness of the sublayers is to provide uniform current levels from each cell (see page 39, lines 12-13). Indeed, the adjustment of the thickness of subcell layers in multi-subcell solar cell devices so that each subcell produces equal current is a well known concept in the solar cell art. For example, Sato et al teaches that “[i]n the double-layer tandem device, the maximum output current is generated when the photovoltaic current of one of the two cells is equal to the photovoltaic current of the other cell, so it is very important to select suitable thicknesses of the cells” (see col. 4, lines 23-27). Likewise, Hanak et al, at col. 3, lines

21-31, notes the adjustment of thickness so that the current produced by solar layers (38) and (42) are the same (see the paragraph bridging paragraphs 2 and 3; and col. 3, lines 43-51). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have prepared Forrest et al ‘725’s stacked organic photosensitive optoelectronic device such that the current generated in a first subcell of the stack is equal to or essentially equal to the current produced by a second subcell in the stack because Forrest et al ‘725 teaches that a stacked device which is connected in series as in embodiment 8D00 in Figure 8D, “fundamental current continuity considerations constrain the device’s current output so that it is limited to the current which goes through the subcell generating the least current regardless of the relative position of a subcell in the stack”; Forrest et al ‘725 addresses this problem by varying the thickness of the photoconductive organic layers, e.g., such that each subcell has exponentially thicker photoconductive organic layers if measured starting at the top of the device; alternatively, Forrest et al ‘725 teaches that when sufficient electromagnetic radiation incident on each face is able to traverse the device, then the layers in the subcells in the center of the device are made thicker than the layers in subcells; Forrest et al ‘725 teaches that the adjustment of the thickness of the sublayers is to provide uniform current levels from each cell; and, furthermore, as shown by Sato et al and Hanak, the adjustment of the thickness of subcell layers in multi-subcell solar cell devices so that each subcell produces equal current is a well known concept in the solar cell art.

7. Claims 20 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Forrest et al '725 in view of Sato et al and Hanak as applied to claims 18, 19, 22-25, and 29 above, and further in view of Peumans et al, "Efficient photon harvesting at high optical intensities in ultrathin organic double–heterostructure photovoltaic devices," Applied Physics Letters, vol. 76(19), pages 2650-2652, May 8, 2000.

Forrest et al '725 in view of Sato et al and Hanak, as relied upon for the reasons recited above, teaches the limitations of the instant claims 20 and 21, the difference being that Forrest et al '725 does not teach the presence of an exciton blocking layer in its stacked organic photosensitive optoelectronic device. Peumans et al teaches that inserting an exciton blocking layer (EBL), such as BCP, between the photoactive region and the metal cathode of an organic photovoltaic device provides the advantages of increasing the efficiency, preventing damage due to cathode evaporation, eliminating parasitic exciton quenching at the electron-acceptor/cathode interface, and increasing the light absorption efficiency (see abstract; and the third paragraph on page 2650). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have included an EBL between the photoactive region and a metal cathode of Forrest et al '725's stacked organic photosensitive optoelectronic devices because the inclusion of the EBL would provide the advantages of increasing the efficiency, preventing damage due to cathode evaporation, eliminating parasitic exciton quenching at the electron-acceptor/cathode interface, and increasing the light absorption efficiency, as taught by Peumans et al.

8. Claims 27 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Forrest et al ‘725 in view of Sato et al and Hanak as applied to claims 18, 19, 22-25, and 29 above, and further in view of Pettersson et al, “Modeling photocurrent action spectra of photovoltaic devices based on organic thin films,” Journal of Applied Physics, vol. 86, no. 1. pages 487-496, July 1, 1999.

Forrest et al ‘725 in view of Sato et al and Hanak, as relied upon for the reasons recited above, teaches the limitations of instant claims 27 and 28, the difference being that Forrest et al ‘725 does not specifically teach presence of an anode-smoothing layer such as PEDOT in its stacked organic photosensitive optoelectronic device. Pettersson et al teaches an organic thin film photovoltaic device comprising an ITO anode; a PEDOT-PSS layer which reads on the instant anode-smoothing layer; a PEOPT hole transport layer; a C_{60} fullerene layer electron transport layer; and an aluminum cathode (see pages 487-488). The PEDOT-PSS layer is used because it provides for better injection/collection conditions resulting in improved current-voltage characteristics compared to ITO/PEOPT. (see page 488, first column). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have used a PEDOT-PSS layer in Forrest et al ‘725’s device because the PEDOT-PSS layer provides for better injection/collection conditions resulting in improved current-voltage characteristics compared to ITO/PEOPT, as taught by Pettersson et al.

9. Claims 18, 19, 22-26, 29, 30, 33, and 37-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Forrest et al (WO 00/11725) in view of Sato et al (U.S. Patent 4,479,028), Hanak (U.S. Patent 4,316,049), and Lewis (U.S. Patent 4,771,321).

As seen in Figure 8A, 8B, 8C, 8D, and 9 Forrest et al ‘725 teaches a stacked organic photosensitive optoelectronic device that comprises in order, an anode, a plurality of photosensitive optoelectronic subcells, and a cathode (see page 1, lines 12-15; page 7, line 33 through page 37, line 1). An example of a heterojunction for a subcell in the stacked device is CuPc/PTCDA or CuPc/PTCBI (see the paragraph bridging cols. 33 and 34). Other heterojunctions are shown on Table 1 at pages 44-45, and include heterojunctions that have C_{60} buckminsterfullerene as an electron transport layer. Between each of the subcells is a semitransparent metallic layer of, for example, 10% Ag and 90% Mg, which has a thickness of 100 Angstroms or less, i.e., instant electron-hole recombination zone (see page 34, line 12 through page 35, line 26). Forrest et al ‘725 teaches that a stacked device which is connected in series as in embodiment 8D00 in Figure 8D, “fundamental current continuity considerations constrain the device’s current output so that it is limited to the current which goes through the subcell generating the least current regardless of the relative position of a subcell in the stack” (see page 38, lines 22-27). Forrest et al ‘725 addresses this problem by varying the thickness of the photoconductive organic layers, e.g., such that each subcell has exponentially thicker photoconductive organic layers if measured starting at the top of the device (see page 38, line 27 through page 39, line 1). Alternatively, when sufficient electromagnetic radiation incident on each face is able to traverse the device, then the layers in the subcells in the center of the device are made thicker than the layers in subcells (see page 39, lines 9-13). The adjustment of the thickness of the sublayers is to provide uniform current levels from each cell (see page

39, lines 12-13). In any event, said semitransparent metallic layer of, for example, 10% Ag and 90% Mg, which has a thickness of 100 Angstroms or less can also be present with said ITO layer as a composite charge transfer layer between the subcells in said Figure 8D.

Forrest et al ‘725 does not specifically recite that the current generated by two of its subcells differs by less than 10%. However as noted above, Forrest et al ‘725 teaches that a stacked device which is connected in series as in embodiment 8D00 in Figure 8D, “fundamental current continuity considerations constrain the device’s current output so that it is limited to the current which goes through the subcell generating the least current regardless of the relative position of a subcell in the stack” (see page 38, lines 22-27). Forrest et al ‘725 addresses this problem by varying the thickness of the photoconductive organic layers, e.g., such that each subcell has exponentially thicker photoconductive organic layers if measured starting at the top of the device (see page 38, line 27 through page 39, line 1). Alternatively, when sufficient electromagnetic radiation incident on each face is able to traverse the device, then the layers in the subcells in the center of the device are made thicker than the layers in subcells (see page 39, lines 9-13). The adjustment of the thickness of the sublayers is to provide uniform current levels from each cell (see page 39, lines 12-13). Indeed, the adjustment of the thickness of subcell layers in multi-subcell solar cell devices so that each subcell produces equal current is a well known concept in the solar cell art. For example, Sato et al teaches that “[i]n the double-layer tandem device, the maximum output current is generated when the photovoltaic current of one of the two cells is equal to the

photovoltaic current of the other cell, so it is very important to select suitable thicknesses of the cells" (see col. 4, lines 23-27). Likewise, Hanak et al, at col. 3, lines 21-31, notes the adjustment of thickness so that the current produced by solar layers (38) and (42) are the same (see the paragraph bridging paragraphs 2 and 3; and col. 3, lines 43-51). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have prepared Forrest et al '725's stacked organic photosensitive optoelectronic device such that the current generated in a first subcell of the stack is equal to or essentially equal to the current produced by a second subcell in the stack because Forrest et al '725 teaches that a stacked device which is connected in series as in embodiment 8D00 in Figure 8D, "fundamental current continuity considerations constrain the device's current output so that it is limited to the current which goes through the subcell generating the least current regardless of the relative position of a subcell in the stack"; Forrest et al '725 addresses this problem by varying the thickness of the photoconductive organic layers, e.g., such that each subcell has exponentially thicker photoconductive organic layers if measured starting at the top of the device; alternatively, Forrest et al '725 teaches that when sufficient electromagnetic radiation incident on each face is able to traverse the device, then the layers in the subcells in the center of the device are made thicker than the layers in subcells; Forrest et al '725 teaches that the adjustment of the thickness of the sublayers is to provide uniform current levels from each cell; and, furthermore, as shown by Sato et al and Hanak, the adjustment of the thickness of subcell layers in multi-subcell solar cell

devices so that each subcell produces equal current is a well known concept in the solar cell art.

With respect to claims 26, 30, 33, and 37-39, Forrest et al ‘725 does not specifically teach that its semitransparent metallic layer between subcells can be the instant nanoparticle layer. Lewis teaches between subcells of a stacked photovoltaic device there can be used a thin layer of ohmic conductive substance, such as aluminum, where said layer forms beads which serve as a shorting interconnect while passing a large fraction of the radiation to the lower subcells and permitting lattice-matching between the subcells to be preserved (see abstract; col. 3, line 15 through col. 4, line 23; claim 12 at col. 12; and Figure 1. The beads are nanoparticles in view of their dimensions (see claim 13 at col. 12). The method of forming Lewis’ interconnect is simple, rugged, and reliable (see col. 4, lines 11-17). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have used Lewis’ beaded interconnect layer for the metallic layer between subcells in Forrest et al ‘725’s device because Lewis teaches that its beaded layer serves as a shorting interconnect while passing a large fraction of the radiation to the lower subcells and permitting lattice-matching between the subcells to be preserved, and the method for preparing the beaded layer is simple, rugged, and reliable.

10. Claims 20, 21, 31, and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Forrest et al ‘725 in view of Sato et al, Hanak, and Lewis as applied to claims 18, 19, 22-26, 29, 30, 33, and 37 above, and further in view of Peumans et al, “Efficient photon harvesting at high optical intensities in ultrathin organic double–

heterostructure photovoltaic devices," Applied Physics Letters, vol. 76(19), pages 2650-2652, May 8, 2000.

Forrest et al '725 in view of Sato et al, Hanak, and Lewis, as relied upon for the reasons recited above, teaches the limitations of the instant claims 20, 21, 31, and 32, the difference being that Forrest et al '725 does not teach the presence of an exciton blocking layer in its stacked organic photosensitive optoelectronic device. Peumans et al teaches that inserting an exciton blocking layer (EBL), such as BCP, between the photoactive region and the metal cathode of an organic photovoltaic device provides the advantages of increasing the efficiency, preventing damage due to cathode evaporation, eliminating parasitic exciton quenching at the electron-acceptor/cathode interface, and increasing the light absorption efficiency (see abstract; and the third paragraph on page 2650). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have included an EBL between the photoactive region and a metal cathode of Forrest et al '725's stacked organic photosensitive optoelectronic devices because the inclusion of the EBL would provide the advantages of increasing the efficiency, preventing damage due to cathode evaporation, eliminating parasitic exciton quenching at the electron-acceptor/cathode interface, and increasing the light absorption efficiency, as taught by Peumans et al.

11. Claims 27, 28, 35, and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Forrest et al '725 in view of Sato et al, Hanak, and Lewis as applied to claims 18, 19, 22-26, 29, 30, 33, and 37 above, and further in view of Pettersson et

al, “Modeling photocurrent action spectra of photovoltaic devices based on organic thin films,” Journal of Applied Physics, vol. 86, no. 1. pages 487-496, July 1, 1999.

Forrest et al ‘725 in view of Sato et al, Hanak, and Lewis as relied upon for the reasons recited above, teaches the limitations of instant claims 27 28, 35, and 36, the difference being that Forrest et al ‘725 does not specifically teach presence of an anode-smoothing layer such as PEDOT in its stacked organic photosensitive optoelectronic device. Pettersson et al teaches an organic thin film photovoltaic device comprising an ITO anode; a PEDOT-PSS layer which reads on the instant anode-smoothing layer; a PEOPT hole transport layer; a C_{60} fullerene layer electron transport layer; and an aluminum cathode (see pages 487-488). The PEDOT-PSS layer is used because it provides for better injection/collection conditions resulting in improved current-voltage characteristics compared to ITO/PEOPT. (see page 488, first column). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have used a PEDOT-PSS layer in Forrest et al ‘725’s device because the PEDOT-PSS layer provides for better injection/collection conditions resulting in improved current-voltage characteristics compared to ITO/PEOPT, as taught by Pettersson et al.

12. Claim 34 is rejected under 35 U.S.C. 103(a) as being unpatentable over Forrest et al ‘725 in view of Sato et al, Hanak, and Lewis as applied to claims 18, 19, 22-26, 29, 30, 33, and 37 above, and further in view of Aratani et al (U.S. Patent 5,854,139).

Forrest et al ‘725 in view of Sato et al, Hanak, and Lewis are relied upon for the reasons recited above. Forrest et al ‘725 in view of Sato et al, Hanak, and Lewis teach

the limitations of claim 34, the difference being that Lewis does not specifically teach that its layer of high ohmic conductance material can be made from silver, as in instant claim 34. Lewis does teach that its layer of high ohmic conductance material can be made from a material such as indium, gallium, aluminum, etc (see col. 3, lines 36-37). Aratani et al teaches what is very well known, i.e., materials such as indium, aluminum, copper, etc, are interchangeably used for ohmic contact materials (see the paragraph bridging cols. 8 and 9). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have used copper in place of indium or aluminum for Lewis' high ohmic conductance material because the substitution of art recognized equivalents, as shown by Aratani et al, would have been within the level of ordinary skill in the art.

Double Patenting

13. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

14. Claims 18 through 39 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-26 of U.S. Patent No. 6,198,091 in view of Forrest et al. (WO 00/11725). Although the conflicting claims are not identical, they are not patentably distinct from each other because Forrest '725 suggests the current matching limitation, as described above in the rejections under 35 U.S.C. §103(a) and the selection of electron-hole recombination zone less than 20 angstroms in thickness is obvious in view of Forrest '725 as stated in the rejections above.. All other structure is present in the claims of the '091 patent.

15. Claims 18-39 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-27 of U.S. Patent No. 6,198,092 in view of Forrest et al. (WO 00/11725). Although the conflicting claims are not identical, they are not patentably distinct from each other because note that claim 3 of said patent teaches that each of the organic photosensitive optoelectronic subcells is selected to maximize the total current output of the device and the selection of electron-hole recombination zone less than 20 angstroms in thickness is obvious in view of Forrest as stated in the rejections above. Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have selected each of the subcells to have an equal or approximately equal current output so as to maximize total current output and to utilize the cell interconnection of Forrest including

the electron-hole recombination zone of less than 20 angstroms thick. It is the Examiner's position that selection of parallel versus series interconnection has long been a matter of selection to one having ordinary skill in the art, and selection of either would have been obvious based on desired current and voltage output of the device.

16. Claims 18-39 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-31 of copending Application No. 10/822,774 in view of Forrest et al. (WO 00/11725). Although the conflicting claims are not identical, they are not patentably distinct from each other because note in claim 30 of said copending application that the first organic layer (i.e., first subcell) and second organic layer (i.e., second subcell) can contribute the same amount of photocurrent to the device and the selection of electron-hole recombination zone less than 20 angstroms in thickness is obvious in view of Forrest as stated in the rejections above.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

17. Claims 18-39 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-29 and 32-36 of copending Application No. 10/910,371 in view of Forrest et al. (WO 00/11725). Although the conflicting claims are not identical, they are not patentably distinct from each other because note in claim 7 of said copending application that the first organic layer (i.e., first subcell) and second organic layer (i.e., second subcell) can contribute the same amount of photocurrent to the device and the selection of electron-hole

recombination zone less than 20 angstroms in thickness is obvious in view of Forrest as stated in the rejections above.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

Response to Arguments

18. Applicant's arguments filed November 5, 2007 have been fully considered but they are not persuasive.

Applicant argues that a reference must be considered in its entirety, and that the ITO layer of Forrest et al provides a recombination zone much thicker than that instantly claimed. This is not persuasive, because the instant limitation to an electron-hole recombination zone does not preclude such an ITO layer also being present. A metal layer less than about 20 Angstroms is obvious from the cited teachings, and electrons and holes will recombine in this area. This meets the limitations of the claim. Whether electrons and holes also recombine in an adjacent ITO layer is does not have any bearing on the rejections. All claimed structure is met by the rejections, and the entirety of the reference has been fully considered.

Applicant argues that Forrest et al ‘725 does not disclose the instant electron-hole recombination zone. Applicant argues that the thin semitransparent metallic layers of Forrest et al are part of a compound cathode, rather than an electron-hole recombination zone. However, this argument is not deemed to be persuasive because Forrest et al’s solar cell has essentially the same structure as in the instant solar cell, e.g., plural CuPc/PTCDA subcells with a semitransparent metallic layer of thickness 100

Angstrom or less containing silver between each of the subcells (see page 34, line 4 through page 35, line 26 of Forrest et al ‘725; and page 7, lines 9-13 of the instant specification). Forrest et al ‘725’s semitransparent metallic layer of thickness 100 Angstrom or less is, for example, 10% Ag and 90% Mg (see page 35, lines 23-35). The instant semitransparent semimetal layer that functions as an electron-hole recombination zone is made from, for example, silver, and has a thickness such that it is thin enough to be semitransparent in order to allow light to reach the back cells (see page 14, lines 24-26, of the instant specification). The point the Examiner is making here is that Forrest et al ‘725 is using essentially same materials to prepare is semitransparent metallic layer as the instant semitransparent layer, Forrest et al ‘725’s semitransparent layer and the instant semitransparent layer have essentially the same thickness, and the layer is located in essentially the same location in the device as the instant layer. Accordingly, it is the Examiner’s position that Forrest et al’s semitransparent metallic layer provides the claimed property of being an electron-hole recombination zone. This is particularly so in Forrest et al ‘725’s Figure 8D (see also page 36, lines 3-8 of Forrest et al ‘725). Forrest et al ‘725’s semitransparent metallic layer will provided whatever properties are associated with it. Just because Applicant has found a new property of Forrest et al ‘725’s semitransparent metallic layer in Forrest et al ‘725’s device does not make essentially the same device patentable. Furthermore, as seen in the instant specification, a layer of silver (semitransparent metal layer) between the subcells can be considered to be the instant electron hole recombination zone, while another layer of silver on the top of the device can be the electrode (see

page 21, lines 26-28). No good reason has been provided as to why Forrest et al '725's semitransparent metal layer containing silver and between the subcells would not provide the property of electron-hole recombination.

Applicant argues that the instant electron-hole recombination zone has a thickness that is less than about 20 angstroms. As stated above, Forrest et al '725 discloses a semitransparent metallic layer of, for example, 10% Ag and 90% M, which has a thickness of 100 Angstroms or less, whereas claim 18 calls for a thickness of less than about 20 Angstroms. However, in the absence of anything unexpected, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have prepared Forrest et al '725's semitransparent metallic layer with a thickness of less than about 20 Angstrom because Forrest et al '725 discloses a semitransparent metallic layer of, for example, 10% Ag and 90% M, which has a thickness of 100 Angstrom or less, which encompasses the instantly claimed range.

Applicant argues that Sato et al, Hanak et al, Peumans et al, Pettersson et al, Aratani et al, and Lewis "do not cure the deficiencies of Forrest et al ['725]." However, as noted above, Forrest et al '725 is not deficient.

Applicant argues that there is no motivation to combine references. However, this argument is not deemed to be persuasive because the motivation to combine references is clearly set forth above. For example, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have prepared Forrest et al '725's stacked organic photosensitive optoelectronic device such that the current generated in a first subcell of the stack is equal to or essentially equal to the current

produced by a second subcell in the stack because Forrest et al ‘725 teaches that a stacked device which is connected in series as in embodiment 8D00 in Figure 8D, “fundamental current continuity considerations constrain the device’s current output so that it is limited to the current which goes through the subcell generating the least current regardless of the relative position of a subcell in the stack”; Forrest et al ‘725 addresses this problem by varying the thickness of the photoconductive organic layers, e.g., such that each subcell has exponentially thicker photoconductive organic layers if measured starting at the top of the device; alternatively, Forrest et al ‘725 teaches that when sufficient electromagnetic radiation incident on each face is able to traverse the device, then the layers in the subcells in the center of the device are made thicker than the layers in subcells; Forrest et al ‘725 teaches that the adjustment of the thickness of the sublayers is to provide uniform current levels from each cell; and, furthermore, as shown by Sato et al and Hanak, the adjustment of the thickness of subcell layers in multi-subcell solar cell devices so that each subcell produces equal current is a well known concept in the solar cell art. It would have been obvious to one of ordinary skill in the art at the time the invention was made to have included an EBL between the photoactive region and a metal cathode of Forrest et al ‘725’s stacked organic photosensitive optoelectronic devices because the inclusion of the EBL would provide the advantages of increasing the efficiency, preventing damage due to cathode evaporation, eliminating parasitic exciton quenching at the electron-acceptor/cathode interface, and increasing the light absorption efficiency, as taught by Peumans et al. It would have been obvious to one of ordinary skill in the art at the time the invention was

made to have used a PEDOT-PSS layer in Forrest et al ‘725’s device because the PEDOT-PSS layer provides for better injection/collection conditions resulting in improved current-voltage characteristics compared to ITO/PEOPT, as taught by Pettersson et al. It would have been obvious to one of ordinary skill in the art at the time the invention was made to have prepared Forrest et al ‘725’s stacked organic photosensitive optoelectronic device such that the current generated in a first subcell of the stack is equal to or essentially equal to the current produced by a second subcell in the stack because Forrest et al ‘725 teaches that a stacked device which is connected in series as in embodiment 8D00 in Figure 8D, “fundamental current continuity considerations constrain the device’s current output so that it is limited to the current which goes through the subcell generating the least current regardless of the relative position of a subcell in the stack”; Forrest et al ‘725 addresses this problem by varying the thickness of the photoconductive organic layers, e.g., such that each subcell has exponentially thicker photoconductive organic layers if measured starting at the top of the device; alternatively, Forrest et al ‘725 teaches that when sufficient electromagnetic radiation incident on each face is able to traverse the device, then the layers in the subcells in the center of the device are made thicker than the layers in subcells; Forrest et al ‘725 teaches that the adjustment of the thickness of the sublayers is to provide uniform current levels from each cell; and, furthermore, as shown by Sato et al and Hanak, the adjustment of the thickness of subcell layers in multi-subcell solar cell devices so that each subcell produces equal current is a well known concept in the solar cell art.

Applicant argues the distinction of the instant claims from those of the '091 patent because of the claiming of "subassemblies" in the '091 patent versus "subcells" in the instant claims. Furthermore, Applicant's arguments focus on dependent claims 5 and 6 of the patent, while the rejection above is made over claims 1-26 in view of the Forrest '725 reference. Even if Applicant's arguments concerning claim 6 of the '091 patent were persuasive, Forrest et al '725 suggests the instant limitation to current matching and the properties of the charge transfer layers as cited in detail in the rejections under 35 U.S.C. §103(a). The double-patenting rejection is therefore maintained.

Applicant argues the distinction of the claims from those of the '092 patent due to the limitation to parallel interconnection in the '092 patent. It is the Examiner's position that selection of parallel versus series interconnection has long been a matter of selection to one having ordinary skill in the art, and selection of either would have been obvious based on desired current and voltage output of the device.

With respect to 10/822,744 (the ‘744 application), Applicant argues that Forrest '725 does not teach or suggest the presently claimed electron-hole recombination zone. The Examiner respectfully disagrees for the reasons given above. Furthermore, Applicant argues that the first organic layer of claims 1-31 of the ‘744 application is a single layer and is a mixture of an organic acceptor and an organic donor material, and that “[t]his is distinct from the subcells of the present claims which comprise two layers -- an electron donor layer and an electron acceptor layer.” Applicant also argues that the second organic layer of claims 1-31 of the ‘744 application is also a single layer and “distinct from the subcells of the present claims which comprise an electron donor and

an electron acceptor." Similar arguments are provided with respect to claims 1-32 of 10/910,371 (the '371 application). However, these arguments are not deemed to be persuasive because the language "comprising an electron donor layer and an electron acceptor layer" in the instant claims is so broad that it encompasses the situation in the claims of the '744 and the '371 applications where the electron donor and electron acceptor are in the same "layer", and the situation in the claims of the '371 application where there is a further unmixed layer acceptor or donor material. The Examiner maintains that the layers described in these patents read on the recited limitation to "an electron donor layer and an electron acceptor layer", and that Applicant appears to be reading portions of the instant specification into the language of the claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dr. Jeffrey T. Barton whose telephone number is (571)272-1307. The examiner can normally be reached on M-F 9:00AM - 5:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on (571) 272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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/Jeffrey T. Barton/
JTB
18 July 2008